



.....

***Medalist 3240***

.....

***Medalist 2531***

.....

***ATA Interface Drives***

.....

.....

***Product Manual***

.....



.....

***Medalist 3240 (ST33240A)***

.....

***Medalist 2531 (ST32531A)***

.....

***ATA Interface Drives***

.....

.....

***Product Manual***

.....



©1997 Seagate Technology, Inc. All rights reserved

Publication Number: 20401033-001, Rev. A, May 1997

Seagate, Seagate Technology, the Seagate logo, Medalist and the Medalist logo are either trademarks or registered trademarks of Seagate Technology, Inc. Other product names are registered trademarks or trademarks of their owners.

Seagate reserves the right to change, without notice, product offerings or specifications. No part of this publication may be reproduced in any form without written permission from Seagate Technology, Inc.

## Contents

<b>Introduction</b>	<b>1</b>
<b>Specification summary table</b>	<b>2</b>
<b>1.0 Drive specifications</b>	<b>5</b>
1.1 Formatted capacity	5
1.1.1 Default logical geometry	5
1.1.2 Supported CHS translation geometries	5
1.2 Physical organization	6
1.3 Recording and interface technology	6
1.4 Physical characteristics	6
1.5 Seek time	7
1.6 Start/stop times	7
1.7 Power specifications	8
1.7.1 Power consumption	8
1.7.2 Conducted noise	9
1.7.3 Voltage tolerance	9
1.7.4 Power-management modes	10
1.8 Environmental tolerances	11
1.8.1 Ambient temperature	11
1.8.2 Temperature gradient	11
1.8.3 Humidity	11
1.8.4 Altitude	11
1.8.5 Shock	12
1.8.6 Vibration	12
1.9 Drive acoustics	13
1.10 Electromagnetic susceptibility	13
1.11 Reliability	13
1.12 Agency certification	14
1.12.1 Safety certification	14

1.12.2 Electromagnetic Compatibility . . . . .	14
1.12.3 FCC verification . . . . .	14
<b>2.0 Drive mounting and configuration . . . . .</b>	<b>17</b>
2.1 Handling and static-discharge precautions . . . . .	17
2.2 Jumper settings . . . . .	17
2.2.1 Master/slave configuration . . . . .	17
2.2.2 Alternate capacity jumper . . . . .	17
2.3 Drive mounting . . . . .	18
<b>3.0 ATA interface . . . . .</b>	<b>21</b>
3.1 ATA interface signals and connector pins . . . . .	21
3.1.1 AT bus signal levels . . . . .	21
3.2 ATA Interface commands . . . . .	23
3.2.1 Supported ATA commands . . . . .	23
3.2.2 Identify Drive command . . . . .	25
3.2.3 Set Features command . . . . .	28
3.2.4 S.M.A.R.T. commands . . . . .	29

## Figures

Figure 1. Typical startup and operation current profile . . . . .	9
Figure 2. Master/slave jumpers and alternate capacity jumper . . .	18
Figure 3. Drive mounting dimensions—top, end and side view . . .	19
Figure 4. I/O pins and supported ATA signals . . . . .	22





## Introduction

The Medalist® 3240 (ST33240A) and Medalist 2531 (ST32531A) provide the following key features:

- Low power consumption
- Quiet operation
- Support for S.M.A.R.T drive monitoring and reporting
- High instantaneous (burst) data-transfer rates (up to 16.6 Mbytes per second) using PIO mode 4 and DMA mode 2
- Full-track multisector transfer capability without local processor intervention
- 128-Kbyte adaptive multisegmented cache
- State-of-the-art caching and on-the-fly error-correction algorithms
- Support for Read/Write Multiple commands
- Support for autodetection of master/slave drives using cable select (CSEL)

## Specification summary table

The specifications listed in this table are for quick reference. For details on specification measurement or definition, see the appropriate section of this manual.

Drive Specification	ST33240A	ST32531A
Guaranteed Mbytes ( $\times 10^6$ bytes)	3,227	2,557
Guaranteed sectors	6,303,024	4,995,648
Bytes per sector	512	512
Default sectors per track	63	
Default read/write heads	16	
Default cylinders	6,253	4,956
Physical read/write heads	8	6
Discs	4	3
Recording density (bits/inch max)	108,770	
Track density (tracks/inch)	5,104	
Areal density (Mbits/inch <sup>2</sup> )	553	
Spindle speed (RPM)	4,500	
Internal data-transfer rate (Mbits/sec max)	88	
I/O data-transfer rate (Mbytes/sec max)	16.6	
ATA data-transfer modes supported	PIO modes 0, 1, 3, 4; Multiword DMA modes 0, 1, 2	
Cache buffer (Kbytes)	128	
Height (mm max)	26.2	
Width (mm max)	102.1	
Length (mm max)	146.9	
Weight (grams typical)	567.5	
Track-to-track seek time (msec typical)	2 (seek), 2.5 (read), 3.5 (write)	
Average seek time (msec typical)	12 (seek), 12.5 (read), 14.5 (write)	
Full-stroke seek time (msec typical)	23.5 (seek), 24 (read), 25 (write)	
Average latency (msec)	6.67	
Power-on to ready (sec typical)	9	
Standby to ready (sec typical)	9	

Drive Specification	ST33240A	ST32531A
Startup current: 12V (peak) 5V (RMS)	1.6 amps 0.5 amps	
Seek power (mean)	4.3 watts	
Operating power (typical)	4.6 watts	
Idle mode power (typical)	4.5 watts	
Standby mode power (typical)	1.0 watts	
Sleep mode power (typical)	0.7 watts	
Voltage tolerance (including noise)	± 5%	
Ambient temperature (°C)	5 to 55 (op.), –40 to 60 (nonop.)	
Temperature gradient (°C per hour max)	20	
Relative humidity (op. and nonop.)	8% to 80%	
Relative humidity gradient	10% per hour max	
Wet bulb temperature (°C max)	29 (op.and nonop.)	
Altitude (meters above mean sea level, max)	–61 to 3,048 (op.) –61 to 12,192 (nonop.)	
Shock, operating (Gs max at 11 msec)	5	
Shock, nonoperating (Gs max at 11 msec)	75	
Vibration, operating	0.020 in. (peak to peak, 5–22 Hz) 0.50 G (0 to peak, 22–350 Hz)	
Vibration, nonoperating	0.081 in. (peak to peak, 5–22 Hz) 5 Gs (0 to peak, 22–350 Hz)	
Drive acoustics (bels—sound power) Idle mode	3.7 (typical) 4.1 (max)	
Drive acoustics (bels—sound power) Read/Write mode	4.3 (typical) 4.5 (max)	
Nonrecoverable read errors	1 per 10 <sup>14</sup> bits read	
Mean time between failures (power-on hours)	300,000	
Contact start-stop cycles (40°C, ambient humidity)	40,000	
Service life (years)	5	



## 1.0 Drive specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience the phrases *the drive* and *this drive* are used throughout this manual to indicate both the ST33240A and the ST32531A.

### 1.1 Formatted capacity

	ST33240A	ST32531A
Guaranteed Mbytes (1 Mbyte = 10 <sup>6</sup> bytes)	3,227	2,557
Guaranteed sectors	6,303,024	4,995,648
Bytes per sector	512	512

**Note.** DOS systems cannot access more than 528 Mbytes on a drive unless 1) the host system supports and is configured for LBA addressing or for extended CHS addressing, 2) the host system contains a specialized drive controller, or 3) the host system runs BIOS translation software. Contact your Seagate® representative for details.

#### 1.1.1 Default logical geometry

CHS Mode	ST33240A	ST32531A
Sectors per track	63	63
Read/Write heads	16	16
Cylinders	6,253	4,956

#### LBA Mode

When addressing either drive in LBA mode, all blocks (sectors) are consecutively numbered from 0 to  $n-1$ .

#### 1.1.2 Supported CHS translation geometries

The ST33240A supports any translation geometry that satisfies *all* of the following conditions:

- Sectors per track  $\leq 63$
- Read/Write heads  $\leq 16$
- (Sectors per track)  $\times$  (Read/Write heads)  $\times$  (cylinders)  $\leq 6,303,024$

The ST32531A supports any translation geometry that satisfies the sectors and head limitations above, and

- (Sectors per track)  $\times$  (Read/Write heads)  $\times$  (cylinders)  $\leq 4,995,648$

## 1.2 Physical organization

	ST33240A	ST32531A
Read/Write heads	8	6
Discs	4	3

## 1.3 Recording and interface technology

Interface	ATA
Recording method	2/3 (1,7) RLL
Recording density (bits/inch)	108,770
Track density (tracks/inch)	5,104
Areal density (Mbits/inch <sup>2</sup> )	553.82
Spindle speed (RPM) ( $\pm 0.5\%$ )	4,500
Internal data-transfer rate (Mbits per second max)	88
I/O data-transfer rate (Mbytes per second max)	16.6 (PIO mode 4 with IORDY) 16.6 (multiword DMA mode 2)
Interleave	1:1
Cache buffer (Kbytes)	128

## 1.4 Physical characteristics

Maximum height	(mm)	26.2
	(inches)	1.03
Maximum width	(mm)	102.1
	(inches)	4.02
Maximum length	(mm)	146.9
	(inches)	5.78
Typical weight	(grams)	567.5
	(pounds)	1.25

## 1.5 Seek time

All seek times are measured using a 486 AT computer (or faster) with an 8.3 MHz I/O bus. The measurements are taken with nominal power at sea level and 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

- Track-to-track seek time is an average of all possible single-track seeks in both directions.
- Average seek time is a true statistical random average of at least 5,000 measurements of seeks between random tracks, less overhead.
- Full-stroke seek time is one-half the time needed to seek from the first data cylinder to the maximum data cylinder and back to the first data cylinder. The full-stroke typical value is determined by averaging 100 full-stroke seeks in both directions.

Seek type	Seek (msec, typ.)	Read (msec, typ.)	Write (msec, typ.)
Track-to-track	2.0	2.5	3.5
Average	12.0	12.5	14.5
Full-stroke	23.5	24.0	25.0

Average latency: 6.67 msec

**Note.** This drive is designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average) are expected to meet or exceed the noted values. Due to the manner in which this drive is formatted, however, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

## 1.6 Start/stop times

Power-on to Ready (sec)	9 (typical)
Standby to Ready (sec)	9 (typical)
Ready to Complete Stop (sec)	9 (typical)

## 1.7 Power specifications

The drive receives DC power (+5V or +12V) through a four-pin standard drive power connector.

### 1.7.1 Power consumption

Power requirements for the drive are listed in the table below. Typical power measurements are based on an average of drives tested under nominal conditions, using 5.0V and 12.0V input voltages at room temperature.

Spinup current is measured from the time of power-on to the time that the drive spindle reaches operating speed.

During seek mode the read/write actuator arm moves toward a specific position on the disc surface before executing a read or write operation. Servo electronics are active. Seek mode power is measured through the drive's serial port while the drive executes a series of sequential seeks.

Operating power and current are measured using 40% random seeks, 40% read/write mode (1 write for each 10 reads), and 20% drive inactive.

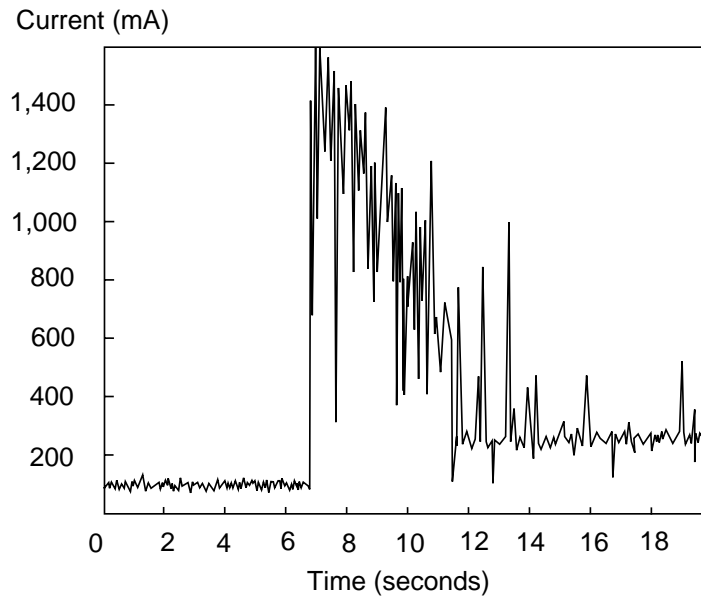
Idle mode power is measured with the drive up to speed, servo electronics are active, and the heads are left in a random track location.

During standby mode the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

Mode	Typical Watts RMS	Typical Amps RMS	
		5V	12V
Spinup		0.5	1.6 (Peak)
Active			
Seeking	4.3	0.425	0.180
Operating			
Read/Write	4.6	0.440	0.200
Idle	4.5	0.440	0.190
Standby	1.0	0.20	—
Sleep	0.7	0.140	—



### 1.7.1.1 Typical current profile



**Figure 1. Typical startup and operation current profile**

Figure 1 shows a typical current profile for the Medalist 3240 and the Medalist 2531.

### 1.7.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15 ohm resistive load on the +5 volt line.

- Using 12-volt power the drive is expected to operate with a maximum of 120 mV peak-to-peak triangular-wave injected noise at up to 25 MHz.
- Using 5-volt power the drive is expected to operate with a maximum of 100 mV peak-to-peak triangular-wave injected noise at up to 25 MHz.

**Note.** Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

### 1.7.3 Voltage tolerance

Voltage tolerance (including noise):  $\pm 5\%$

### 1.7.4 Power-management modes

This drive provides programmable power management to provide greater energy efficiency. In most systems, you can control power management through the system setup program. This Seagate drive features several power-management modes, which are summarized in the following table and described in more detail below:

Mode	Heads	Spindle	Buffer
Active	Moving	Rotating	Enabled
Idle	Move every 3 minutes	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

**Active mode.** The drive is in Active mode during the read/write and seek operations.

**Idle mode.** At power-on, the drive sets the idle timer to enter Idle mode after 5 seconds of inactivity. You can set the idle timer delay using the system setup utility. In Idle mode, the spindle remains up to speed. Every 3 minutes, the drive performs a random seek. The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disc access is necessary.

**Standby mode.** The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is system-dependent and is usually established using the system setup utility. In Standby mode, the buffer remains enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disc access is necessary.

**Sleep mode.** The drive enters Sleep mode after receiving a Sleep Immediate command from the host. The heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset command from the host. After receiving a soft reset, the drive exits Sleep mode and enters Standby mode with all current emulation and translation parameters intact.

**Idle and standby timers.** The drive sets the default time delay for the idle timer at power-on. In most systems, you can set this delay using the system setup utility. Each time the drive performs an Active function (read, write or seek), the idle and standby timers are reinitialized and begin counting down from their specified delay times to zero. If the idle timer reaches zero before

any drive activity is required, the drive makes a transition to Idle mode. If the host has set the standby timer, the standby countdown continues. If the host has not set the standby timer, the drive remains in Idle mode. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disc access is necessary.

## 1.8 Environmental tolerances

### 1.8.1 Ambient temperature

Operating	5° to 55°C (41° to 131°F)
Nonoperating	–40° to 60°C (–40° to 140°F)

**Note.** Above 1,000 feet (305 meters), the maximum temperature is derated linearly to 112 °F (44°C) at 10,000 feet (3,048 meters). Operating ambient temperature is defined as the temperature of the environment immediately surrounding the drive.

### 1.8.2 Temperature gradient

Operating	20°C / hr (68°F / hr) max, without condensation
Nonoperating	20°C / hr (68°F / hr) max, without condensation

### 1.8.3 Humidity

#### 1.8.3.1 Relative humidity

Operating	8% to 80% noncondensing (10% per hour max)
Nonoperating	8% to 80% noncondensing (10% per hour max)

#### 1.8.3.2 Wet bulb temperature

Operating	28.9°C (84°F) max
Nonoperating	28.9°C (84°F) max

### 1.8.4 Altitude

Operating	–61 m to 3,048 m (–200 ft to +10,000 ft)
Nonoperating	–61 m to 12,192 m (–200 ft to +40,000 ft)

### 1.8.5 Shock

For all shock specifications, it is assumed that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis. For the nonoperating specifications, it is assumed that the read/write heads are positioned in the shipping zone.

**Note.** At power-down, the read/write heads automatically move to the shipping zone. The head assembly parks outside of the maximum data cylinder. When power is applied, the heads recalibrate to Track 0.

#### 1.8.5.1 Operating shock

The Medalist 3240 and the Medalist 2531 will comply with the performance levels specified in this document when subjected to a maximum operating shock of 5.0 Gs (based on half-sine shock pulses of 11 msec, as specified in MIL-STD-202F). Shocks are not to be repeated more than two times per second.

#### 1.8.5.2 Nonoperating shock

The nonoperating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 75 Gs (based on nonrepetitive half-sine shock pulses of 11 msec duration, as defined in MIL-STD-202F).

### 1.8.6 Vibration

For all vibration specifications, it is assumed that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. For the nonoperating specifications, it is assumed that the read/write heads are positioned in the shipping zone.

#### 1.8.6.1 Operating vibration

The following table lists the maximum vibration levels that the drive may experience while meeting the performance standards specified in this document.

5–22 Hz	0.020 inches displacement (peak to peak)
22–350 Hz	0.50 Gs acceleration (zero to peak)

### 1.8.6.2 Nonoperating vibration

The following table lists the maximum nonoperating vibration that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation.

5–22 Hz	0.081-inch displacement (peak to peak)
22–350 Hz	5 Gs acceleration (zero to peak)

## 1.9 Drive acoustics

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are generally consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

Mode	Typical sound power (bels)	Maximum sound power (bels)
Idle	3.7	4.1
Read/Write	4.3	4.5

## 1.10 Electromagnetic susceptibility

The drive operates without errors when subjected to the following:

Radiated noise	$\leq 3$ volt/meter, 30 Hz to 1 GHz
Electrostatic discharge*	$\leq 10$ KVolts
Magnetic field strength	$\leq 5$ Gauss

\* Electrostatic discharge susceptibility is measured with the drive mounted in a representative computer system (mounted to a ground plane with earth grounding). Discharges are applied to the bezel or other external surfaces on the ground plane.

## 1.11 Reliability

Nonrecoverable read errors	1 per $10^{14}$ bits read, max
Mean time between failures	300,000 power-on hours (nominal power, 25°C ambient temperature)

Contact start-stop cycles	40,000 cycles (at nominal voltage and temperature, with 60 cycles per hour and a 50% duty cycle)
Preventive maintenance	None required

## **1.12 Agency certification**

### **1.12.1 Safety certification**

The drive is recognized in accordance with UL 1950 and CSA C22.2 (950) and meets all applicable sections of IEC 950 and EN 60950 as tested by TUV North America.

### **1.12.2 Electromagnetic Compatibility**

Hard drives that display the CE marking comply with European Union requirements specified in Electromagnetic Compatibility Directives. Testing is performed to standards EN50082-1 and EN55022-B.

Seagate uses an independent laboratory to confirm compliance with the EC directives specified in the previous paragraph. Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

### **1.12.3 FCC verification**

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate Technology, Inc. has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disc drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with noncertified assemblies is likely to result in interference to radio and television reception.

**Radio and Television Interference.** This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, you are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, you should consult your dealer or an experienced radio/television technician for additional suggestions. You may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.





## **2.0 Drive mounting and configuration**

### **2.1 Handling and static-discharge precautions**

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. You must observe standard static-discharge precautions. A grounded wrist-strap is preferred.

Handle the drive only by the sides of the head/disc assembly. Avoid contact with the printed circuit board, all electronic components and the interface connector. Do not apply pressure to the top cover of the drive. Always rest the drive on a padded antistatic surface until you mount it in the host system.

### **2.2 Jumper settings**

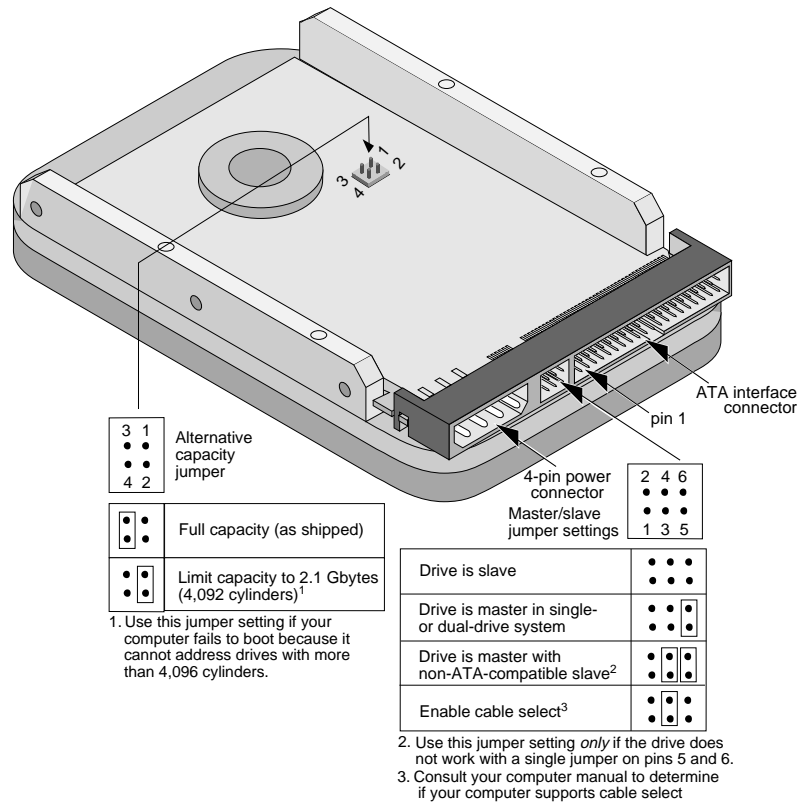
#### **2.2.1 Master/slave configuration**

You must establish a master/slave relationship between two drives that are attached to a single AT bus. You can configure a drive to become a master or slave by setting the master/slave jumpers, shown in Figure 2 on page 18. This drive supports master/slave configuration using the cable select option. This requires a special daisy-chain cable that grounds pin 28 (CSEL) on one of its two drive connectors. If you attach the drive to the grounded CSEL connector, it becomes a master. If you attach the drive to the ungrounded CSEL connector, it becomes a slave. To use this option, the host system and both drives must support cable select, and both drives must be configured for cable select. To configure this drive for cable select, install a jumper as shown in Figure 2.

For the master drive to recognize the slave drive using the DASP– signal, the slave drive must assert the DASP– signal at power up, and the master drive must monitor DASP– at power up.

#### **2.2.2 Alternate capacity jumper**

Some older computers may “hang” if their BIOS detects a hard drive that has more than 4,092 cylinders at startup. To allow these computers to recognize the ST33240A and the ST32531A, this drive includes a capacity-limiting jumper, which sets the drive’s default translation geometry to 4,092 cylinders. This limits the drive’s capacity to 2.1 Gbytes, unless third-party software is used.

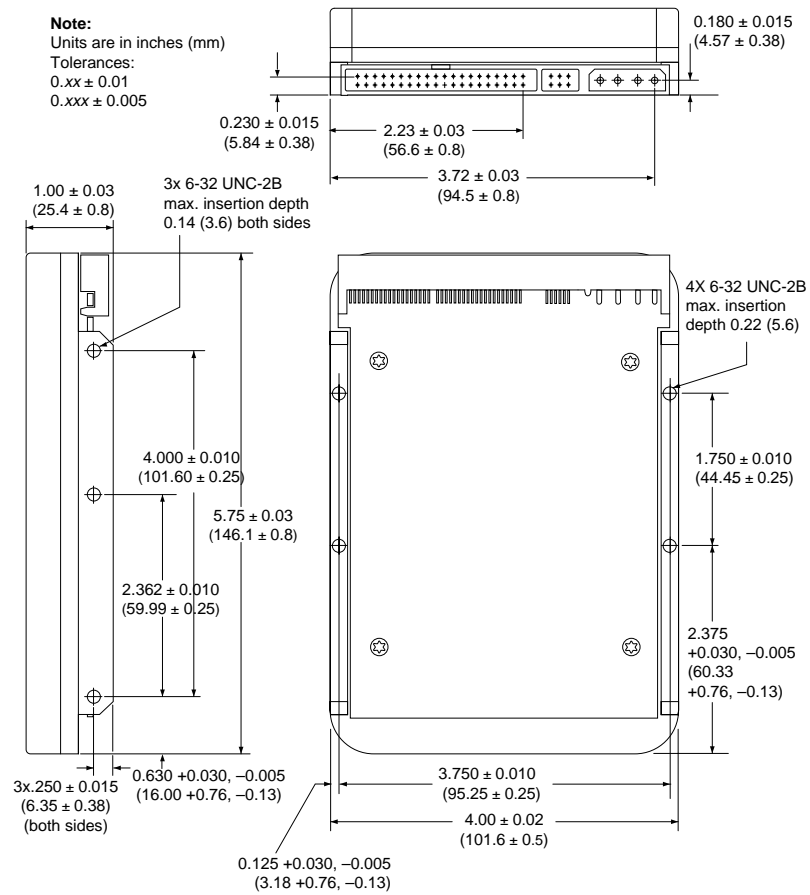


**Figure 2. Master/slave jumpers and alternate capacity jumper for the ST33240A and ST32531A**

## 2.3 Drive mounting

You can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. See Figure 3 on page 19 for drive mounting dimensions.

- Allow a minimum clearance of 0.030 inches (0.76 mm) around the entire perimeter of the drive for cooling.
- Use only 6x32 UNC mounting screws.
- Do not insert the mounting screws more than 0.22 inches (5.6 mm) into the bottom mounting holes.
- Do not insert the mounting screws more than 0.14 inches (3.6 mm) into the side mounting holes.
- Do not overtighten the mounting screws (maximum torque: 3 inch-lb).
- Do not use a drive interface cable that is more than 18 inches long.



**Figure 3. Mounting dimensions for the ST33240A and ST32531A—top, side and end view**



## 3.0 ATA interface

This drive uses the industry-standard ATA task file interface. It supports both 8-bit and 16-bit data transfers. It supports ATA programmed input/output (PIO) modes 0, 1, 2, 3 and 4; ATA single-word DMA modes 0, 1 and 2; and ATA multiword DMA modes 0, 1 and 2. The drive also supports the use of the IORDY signal to provide reliable high-speed data transfers.

You can use a daisy-chain cable to connect two drives to a single AT host bus. For detailed information regarding the ATA interface, refer to the *Draft ATA-3 document X3T10 2008, Revision 6*, subsequently referred to as the *Draft Proposed ATA-3 Standard*.

### 3.1 ATA interface signals and connector pins

Figure 4 on page 22 summarizes the signals on the ATA interface connector that the drive supports. For a detailed description of these signals, refer to the *Draft Proposed ATA-3 Standard*.

#### 3.1.1 AT bus signal levels

Signals that the drive receives must have the following characteristics at the drive connector:

Logic low	0.0V to 0.7V
Logic high	2.0V to 5.25V

Drive pin #	Signal name	Host pin # and signal description
1	Reset	1 Host Reset
2	Ground	2 Ground
3	DD7	3 Host Data Bus Bit 7
4	DD8	4 Host Data Bus Bit 8
5	DD6	5 Host Data Bus Bit 6
6	DD9	6 Host Data Bus Bit 9
7	DD5	7 Host Data Bus Bit 5
8	DD10	8 Host Data Bus Bit 10
9	DD4	9 Host Data Bus Bit 4
10	DD11	10 Host Data Bus Bit 11
11	DD3	11 Host Data Bus Bit 3
12	DD12	12 Host Data Bus Bit 12
13	DD2	13 Host Data Bus Bit 2
14	DD13	14 Host Data Bus Bit 13
15	DD1	15 Host Data Bus Bit 1
16	DD14	16 Host Data Bus Bit 14
17	DD0	17 Host Data Bus Bit 0
18	DD15	18 Host Data Bus Bit 15
19	Ground	19 Ground
20	(removed)	20 (No Pin)
21	DMARQ	21 DMA Request
22	Ground	22 Ground
23	DIOW	23 Host I/O Write
24	Ground	24 Ground
25	DIOR	25 Host I/O Read
26	Ground	26 Ground
27	IORDY	27 I/O Channel Ready
28	CSEL	28 Cable Select pin
29	DMACK	29 DMA Acknowledge
30	Ground	30 Ground
31	INTRQ	31 Host Interrupt Request
32	IOCS16	32 Host 16 Bit I/O
33	DA1	33 Host Address Bus Bit 1
34	PDIAG	34 Passed Diagnostics
35	DA0	35 Host Address Bus Bit 0
36	DA2	36 Host Address Bus Bit 2
37	CS1FX	37 Host Chip Select 0
38	CS3FX	38 Host Chip Select 1
39	DASP	39 Drive Active / Slave Present
40	Ground	40 Ground

Pins 28, 34 and 39 are used for master-slave communication (details shown below).

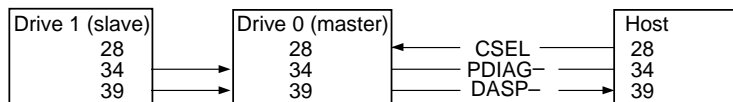


Figure 4. I/O pins and supported ATA signals

## 3.2 ATA Interface commands

### 3.2.1 Supported ATA commands

The following table lists ATA-standard commands that the drive supports. For a detailed description of the ATA commands, refer to the *Draft Proposed ATA-3 Standard*. See section 3.2.4 on page 29 for details and subcommands used in the S.M.A.R.T. implementation.

Command name	Command code	Supported by this drive
<b>ATA-standard commands</b>		
Execute Drive Diagnostics	90H	Yes
Execute S.M.A.R.T. Command	B0H	Yes
Format Track	50H	Yes
Identify Drive	EC <sub>H</sub>	Yes
Initialize Drive Parameters	91H	Yes
NOP	00H	No
Read Buffer	E4H	Yes
Read DMA (w/retry)	C8H	Yes
Read DMA (no retry)	C9H	Yes
Read Long (w/retry)	22H	Yes
Read Long (no retry)	23H	Yes
Read Multiple	C4H	Yes
Read Sectors (w/retry)	20H	Yes
Read Sectors (no retry)	21H	Yes
Read Verify Sectors (w/retry)	40H	Yes
Read Verify Sectors (no retry)	41H	Yes
Recalibrate	10H	Yes
Seek	70H	Yes
Set Features	EF <sub>H</sub>	Yes

*continued*

*continued from previous page*

<b>Command name</b>	<b>Command code</b>	<b>Supported by this drive</b>
Set Multiple Mode	C6 <sub>H</sub>	Yes
Write Buffer	E8 <sub>H</sub>	Yes
Write DMA (w/retry)	CA <sub>H</sub>	Yes
Write DMA (no retry)	CB <sub>H</sub>	Yes
Write Long (w/retry)	32 <sub>H</sub>	Yes
Write Long (no retry)	33 <sub>H</sub>	Yes
Write Multiple	C5 <sub>H</sub>	Yes
Write Same	E9 <sub>H</sub>	No
Write Sectors (w/retry)	30 <sub>H</sub>	Yes
Write Sectors (no retry)	31 <sub>H</sub>	Yes
Write Verify	3C <sub>H</sub>	No
<b>ATA-standard power-management commands</b>		
Check Power Mode	98 <sub>H</sub> or E5 <sub>H</sub>	Yes
Idle	97 <sub>H</sub> or E3 <sub>H</sub>	Yes
Idle Immediate	95 <sub>H</sub> or E1 <sub>H</sub>	Yes
Sleep	99 <sub>H</sub> or E6 <sub>H</sub>	Yes
Standby	96 <sub>H</sub> or E2 <sub>H</sub>	Yes
Standby Immediate	94 <sub>H</sub> or E0 <sub>H</sub>	Yes



The following commands contain drive-specific features that may not be described in the *Draft Proposed ATA-3 Standard*.

### 3.2.2 Identify Drive command

The Identify Drive command (command code ECH) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in the table below. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive. See Section 1 of this manual for default parameter settings for the Medalist 3240 and the Medalist 2531.

**Note.** If the alternate capacity jumper is installed on the ST33240A or ST32531A, the drive capacity is reduced in Word 1 to 4,092 cylinders.

Word	Description	Contents
0	Configuration information: <ul style="list-style-type: none"> <li>• Bit 10: disc transfer &gt; 10 Mbits/sec</li> <li>• Bit 6: fixed drive</li> <li>• Bit 4: head switch time &gt; 15 <math>\mu</math>sec</li> <li>• Bit 3: not MFM encoded</li> <li>• Bit 1: hard-sectored disc</li> </ul>	0C5AH
1	Number of fixed cylinders (default logical emulation): 6,253 (ST33240A) 4,956 (ST32531A)	186DH (ST33240A) 135CH (ST32531A)
2	ATA-reserved	0000H
3	Number of heads (default logical emulation): 16	0010H
4	Number of unformatted bytes per track (not used)	0000H
5	Number of unformatted bytes per sector (not used)	0000H
6	Number of sectors per track (default logical emulation): 63	003FH
7–9	ATA-reserved	0000H
10–19	Serial number: (20 ASCII characters, 0000H = none)	ASCII

*continued*

*continued from previous page*

Word	Description	Contents
20	Controller type = dual-port multisector buffer with caching (not used)	0000 <sub>H</sub>
21	Buffer size (not used)	0000 <sub>H</sub>
22	Number of ECC bytes available (4)	0004 <sub>H</sub>
23–26	Firmware revision (8 ASCII character string):	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	ST33240A or ST32531A
47	(Bits 0–7) Maximum sectors per interrupt on read/write multiple (16)	8010 <sub>H</sub>
48	Double word I/O (not supported)	0000 <sub>H</sub>
49	DMA data transfer, IORDY (supported), LBA mode, ATA-2 standby times supported	0F01 <sub>H</sub>
50	ATA-reserved	0000 <sub>H</sub>
51	PIO data-transfer cycle timing mode	0100 <sub>H</sub>
52	DMA transfer cycle timing mode	0200 <sub>H</sub>
53	Validity of words 54–58 and words 64–70 (words may be valid)	0003 <sub>H</sub>
54	Number of cylinders (current emulation mode)	xxxx <sub>H</sub>
55	Number of heads (current emulation mode)	xxxx <sub>H</sub>
56	Number of sectors per track (current emulation mode)	xxxx <sub>H</sub>
57–58	Number of sectors (current emulation mode)	xxxx <sub>H</sub>
59	Number of sectors transferred during a Read Multiple or Write Multiple command	01xx <sub>H</sub>
60	LBA sectors available (w/word 61): 6,303,024 (ST33240A) 4,995,648 (ST32531A)	2D30 <sub>H</sub> (ST33240A) 3D4C <sub>H</sub> (ST32531A)

Word	Description	Contents
61	LBA sectors available (continued)	0060 <sub>H</sub> (ST33240A) 007C <sub>H</sub> (ST32531A)
62	ATA-obsolete	0000 <sub>H</sub>
63	Multiword DMA active and modes supported (see note following this table)	0x07 <sub>H</sub>
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 <sub>H</sub>
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 <sub>H</sub>
67	Minimum PIO cycle time without IORDY flow control (383 nsec)	017F <sub>H</sub>
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 <sub>H</sub>
69–127	ATA-reserved	0000 <sub>H</sub>
128–159	Seagate-reserved	xxxx <sub>H</sub>
160–255	ATA-reserved	0000 <sub>H</sub>

**Note.** The following DMA mode settings are used in word 63 of the Identify Drive command:

Word	Bit	Description (if bit is set to 1)
63	0	Multiword DMA mode 0 available
63	1	Multiword DMA mode 1 available
63	2	Multiword DMA mode 2 available
63	8	Multiword DMA mode 0 currently active
63	9	Multiword DMA mode 1 currently active
63	10	Multiword DMA mode 2 currently active

### 3.2.3 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled and 4 bytes of ECC. The acceptable values for the Features register are defined as follows:

- 02<sub>H</sub> Enable write cache (*default*)
- 03<sub>H</sub> Set transfer mode (based on value in Sector Count register)  
Sector Count register values:
  - 00<sub>H</sub> Set PIO mode to default (PIO mode 2)
  - 01<sub>H</sub> Set PIO mode to default and disable IORDY (PIO mode 2)
  - 08<sub>H</sub> PIO mode 0
  - 09<sub>H</sub> PIO mode 1
  - 0A<sub>H</sub> PIO mode 2 (*default*)
  - 0B<sub>H</sub> PIO mode 3
  - 0C<sub>H</sub> PIO mode 4
  - 10<sub>H</sub> Single-word DMA mode 0
  - 11<sub>H</sub> Single-word DMA mode 1
  - 12<sub>H</sub> Single-word DMA mode 2
  - 20<sub>H</sub> Multiword DMA mode 0
  - 21<sub>H</sub> Multiword DMA mode 1
  - 22<sub>H</sub> Multiword DMA mode 2
- 44<sub>H</sub> Sixteen bytes of ECC apply on read long and write long commands
- 55<sub>H</sub> Disable read look-ahead (read cache) feature
- 66<sub>H</sub> Disable reverting to power-on defaults
- 82<sub>H</sub> Disable write cache
- AA<sub>H</sub> Enable read look-ahead (read cache) feature (*default*)
- BB<sub>H</sub> 4 bytes of ECC apply on read long and write long commands (*default*)
- CC<sub>H</sub> Enable reverting to power-on defaults (*default*)

At power-on, or after a hardware reset, the default values of the features are as indicated above. A software reset also changes the features to default values unless a 66<sub>H</sub> command has been received.

### 3.2.4 S.M.A.R.T. commands

Self-Monitoring, Analysis and Reporting Technology (S.M.A.R.T.) is an emerging technology that provides near-term failure prediction for disc drives. When S.M.A.R.T. is enabled, the Seagate drive monitors predetermined drive attributes that are susceptible to degradation over time. If a failure is likely to occur, S.M.A.R.T. makes a status report available so that the host can prompt the user to back up data on the drive. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft Proposed ATA-3 Standard*.

This drive is shipped with S.M.A.R.T. features disabled. You must have a recent BIOS or software package that supports S.M.A.R.T. to enable the feature. The table below shows the S.M.A.R.T. command codes that these drives use.

Before executing a S.M.A.R.T. command by writing B0<sub>H</sub> to the Command Register, the host must do the following:

- Write the value 4F<sub>H</sub> to Cylinder\_Low register.
- Write the value C2<sub>H</sub> to the Cylinder\_High register.
- Write the appropriate S.M.A.R.T. code to the Features register, as shown in the table below:

Code in Features Register	S.M.A.R.T. Command	Supported by Medalist 3240 and Medalist 2531
D0 <sub>H</sub>	Enable/Disable Attribute Autosave	Yes
D1 <sub>H</sub>	Enable S.M.A.R.T. Operations	Yes
D2 <sub>H</sub>	Enable/Disable Attribute Autosave	Yes
D3 <sub>H</sub>	Save Attribute Values	Yes
D4 <sub>H</sub>	Execute Off-line Immediate	Yes
D7 <sub>H</sub>	Write Warranty Threshold	Yes
D8 <sub>H</sub>	Enable S.M.A.R.T. Operations	Yes
D9 <sub>H</sub>	Disable S.M.A.R.T. Operations	Yes
DA <sub>H</sub>	Return S.M.A.R.T. Status	Yes

<b>Code in Features Register</b>	<b>S.M.A.R.T. Command</b>	<b>Supported by Medalist 3240 and Medalist 2531</b>
DB <sub>H</sub>	Enable/disable Automatic Off-line	Yes

**Note.** If an appropriate code is not written to the Features Register, the command will be aborted and 0x04 (abort) will be written to the Error register.





**Seagate Technology, Inc.**

**920 Disc Drive, Scotts Valley, California 95066, USA**

*Publication Number: 20401033-001, Rev. A, Printed in USA*